

Africa's megafans and their tectonic setting

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Megafans are areally extensive continental sediment bodies, fluvially derived, and fan-shaped in planform. Only those >80 km long were included in this study. Africa's megafans were mapped for purposes of both comprehensive geomorphic description and as a method of mapping by remote sensing large probable fluvial sediment bodies (we exclude sediment bodies deposited in well defined, modern floodplains and coastal deltas). Our criteria included a length dimension of >80 km and maximum width >40 km, partial cone morphology, and a radial drainage pattern. Visible and especially IR imagery were used to identify the features, combined with topographic SRTM data.

We identified 99 megafans most of which are unstudied thus far. Their feeder rivers responsible for depositing megafan sediments rise on, and are consequent drainages oriented down the slopes of the swells that have dominated African landscapes since ~34 Ma (the high points in Africa's so-called *basin-and-swell* topography [1]). Most megafans (66%) have developed along these consequent rivers relatively near the swell cores, oriented radially away from the swells. The vast basins between the swells provide accommodation for megafan sediment wedges. Although clearly visible remotely, most megafans are inactive as a result of incision by the feeder river (which then no longer operates on the fan surface).

Two tectonic settings control the location of Africa's megafans, 66% on swell flanks, and 33% related to rifts.

(i) Swell flanks Most megafans are apexed relatively near the core of the parent swell, and are often clustered in groups: e.g., six on the west and north flanks of the Hoggar Swell (Algeria), seven on the north and south flanks of the Tibesti Swell (Libya-Chad borderlands), twelve on the west flank of the Ethiopian Swell, four on the east flank of the East African Swell (Kenya), Africa's largest, and eight around Angola's Bié Swell (western Zambia, northern Namibia). A cluster of possible fans lies on the western margin of the Congo Basin (Mayombe Swell), and on the coastal slopes of the Namibia Swell. Sheer size may have militated against the recognition of many megafans: the largest in the Sahara are the Teghahart (378 km, Hoggar Swell, Algeria), and the Wadi Albalata (340 km, Uweinat Swell, Egypt). In southern Africa the largest are the Cubango (320 km, Bié Swell, Angola/ Namibia), and the Limpopo (230 km, Mozambique).

(ii) Rift zones (a) *Steer's horns* basins—wide depressions centered on rifts. The largest contiguous group (n=14) developed in a steer's-horns basin occupies the wide Muglad depression (200-350 km, South Sudan). Four rift-related megafans lie SE of Lake Chad (Chad). Nine megafans occupy the complex Anza Rift in Kenya/South Somalia. The Salamat megafan (Chad), is unusual because it oriented *parallel with* the linked Salamat, Doseo and Doba rift axes, and is consequently one of the longest in Africa (465 km). (b) Rift depressions *sensu stricto*. Most rifts are too narrow to provide a transverse dimension large enough to accommodate megafans. Although well-known, the Okavango Rift (NW Botswana, NE Namibia) is unique in Africa in hosting three megafans within identifiable faulted margins.

The Nile megafan is Africa's largest (476 km) and comprises the vast Sudd wetland (South Sudan). An explanation for its remarkable size may be its location in a depression at the junction of two conducive tectonic zones, the East African Swell margin and the Muglad steer's-horns depression. Discharge of the River Nile, the largest in the region, has allowed the Nile megafan to outcompete neighboring megafans for space.

Reference:

[1] Burke K and Gunnell Y (2008) Geol. Soc. America, Memoir 201. 66 pp.

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